

What happens to the electrolyte in a lithium-ion cell as the cell ages?

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It seems reasonable that if a lithium-ion cell is to last many decades that the electrolyte in the cell should change very slowly over time, if at all, during cell operation. For example, the salt content should not change, the solvents should not degrade and the amount of liquid electrolyte in the cell should not change.

Unfortunately the electrolyte in lithium-ion cells does change as cells age which ultimately limits their lifetime. These changes occur due to reactions between the charged electrode materials and the electrolyte. These can consume the salt and alter the solvent content as well as create liquid, gaseous and solid by-products.

We have invested time to develop methods to analyze the electrolyte in aged cells using destructive methods [e.g. 1, 2] and non-destructive methods [3]. In this presentation, we will describe the uncommon, yet effective, methods presented in references 2 and 3 as well as experiments on NMC/graphite cells tested for long periods of time under aggressive conditions. The results show how the electrolyte evolves versus time and cycle number for these cells.

References:

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- [3.] R.P. Day, J. Xia, R. Petibon, J. Rucska, H. Wang, J.R. Dahn, Differential Thermal Analysis of Li-ion Cells as an Effective Probe of Liquid Electrolyte Evolution during Aging, *J. Electrochem. Soc.* **162**, A2577-A2581 (2015)